

Distributed Systems, Summer Term 2020

Exercise Sheet 10

1 Gather everything in CONGEST

We are given a graph $G = (V, E)$ and we want each node to know the whole graph. We have seen during the lecture that such problem can be solved in $O(\text{diam}(G))$ rounds in the LOCAL model. Show that it is possible to solve this problem in $O(|E|)$ in the CONGEST model.

2 APSP: Slow token

During the lecture we have seen two animations of the APSP algorithm:

- One where the token is moved slowly (every 2 rounds), and there are no waves that collide.
- One where the token is moved fast (every round), and many waves collide.

Prove that it is indeed true that, if we move the token every two rounds, each node at each round has to propagate at most one wave.

3 Edge counting

Show that, in the CONGEST model, it is possible to count the number of edges of the graph in $O(\text{diam}(G))$ rounds.

4 Bipartite graph

Show that, in the CONGEST model, it is possible to detect if the graph is bipartite or not. In particular, all nodes have to output 1 if the graph is bipartite, and 0 otherwise. Show an algorithm that solves this problem in $O(\text{diam}(G))$ rounds.